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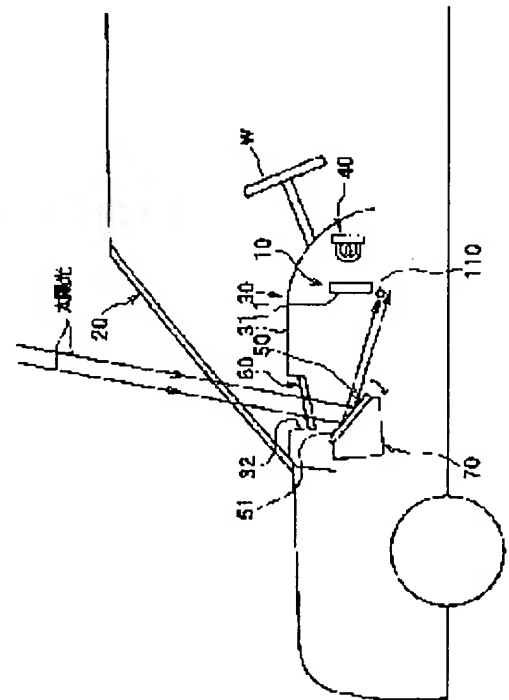
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TAMURA SATORU**(54) HEAD-UP DISPLAY FOR VEHICLE****(57)Abstract:**

PROBLEM TO BE SOLVED: To provide a head-up display for vehicle in which a reflection mirror for reflecting a light indicating an indication information of indicator toward a front wind shield does not made a sun light from the front wind shield reversely incident to the indicator without depending on an excess optical member.

SOLUTION: Even if a reflection mirror 50 reflects a sun light incident through a front wind shield 20 and a dust prevention cover 60, a pivoting position of the reflection mirror 50 is adjusted by a pivoting position adjusting device 10 such that the reflection light is not incident to a liquid crystal panel 10.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the whole outline block diagram showing 1 operation gestalt of the HUD for automobiles concerning this invention.

[Drawing 2] It is the side elevation of the rotation justification equipment of drawing 1 .

[Drawing 3] It is the side elevation of the rotation justification equipment of drawing 1 .

[Drawing 4] It is the side elevation of the rotation justification equipment of drawing 1 .

[Drawing 5] It is the control circuit Fig. which controls the liquid crystal panel of drawing 1 , and the motor of drawing 2 .

[Drawing 6] It is the pre-stage of the flow chart which shows an operation of the microcomputer of drawing 5 .

[Drawing 7] It is the post-stage of the flow chart which shows an operation of the microcomputer of drawing 5 .

[Drawing 8] It is the graph which shows the time rise of the temperature of the liquid crystal panel concerned in case sunlight carries out reverse incidence to a liquid crystal panel.

[Drawing 9] It is the side elevation showing the condition that sunlight carries out reverse incidence to a liquid crystal panel 10 in the above-mentioned operation gestalt.

[Drawing 10] It is the side elevation showing the condition of preventing the reverse incidence to the liquid crystal panel of sunlight in the above-mentioned operation gestalt.

[Drawing 11] It is the important section outline side elevation showing the modification of the above-mentioned operation gestalt.

[Drawing 12] It is the side elevation showing the condition of preventing the reverse incidence to the liquid crystal panel of sunlight in the above-mentioned modification.

[Description of Notations]

IG [-- A front windshield, 30 / -- An instrument panel, 32 / -- Opening, 40 / -- The light source, 50 / -- A reflecting mirror, 51 / -- A reflector, 60 / -- A reflecting mirror, 70 / -- Rotation justification equipment, 90 / -- A switch actuation switch, 100 / -- An actuation switch, 110 / -- Temperature sensor.] -- An ignition switch, 10 -- A liquid crystal panel, 11 -- The screen, 20

[Translation done.]

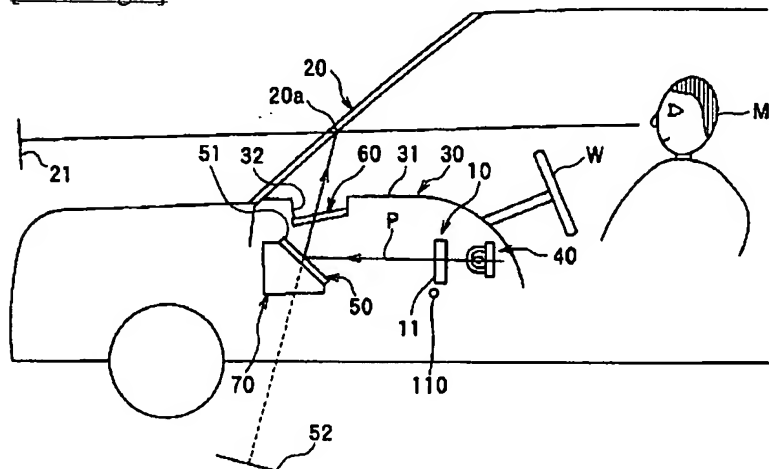
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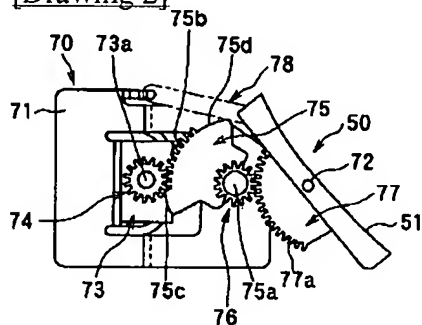
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DRAWINGS

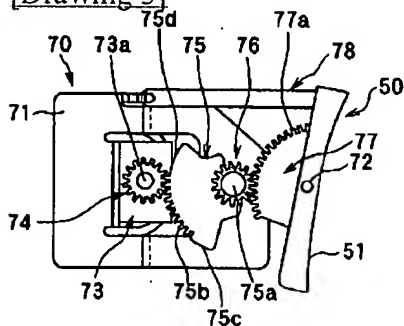
[Drawing 1]



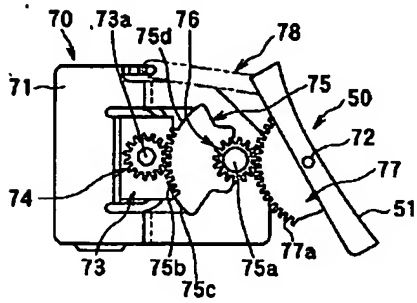
[Drawing 2]



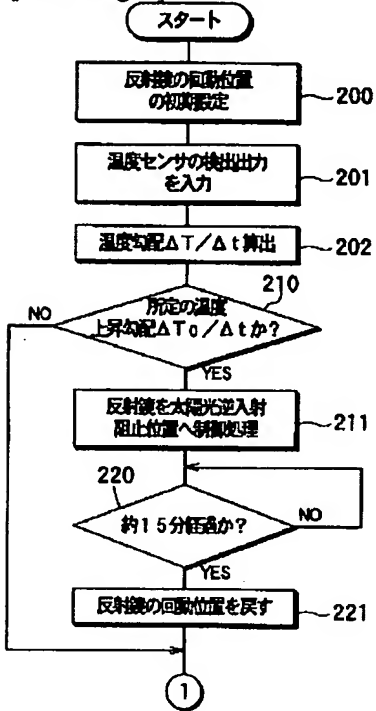
[Drawing 3]



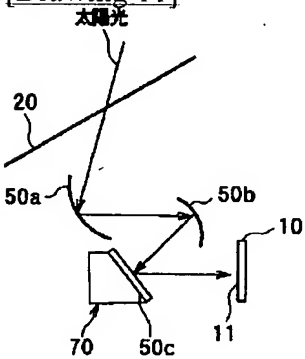
[Drawing 4]



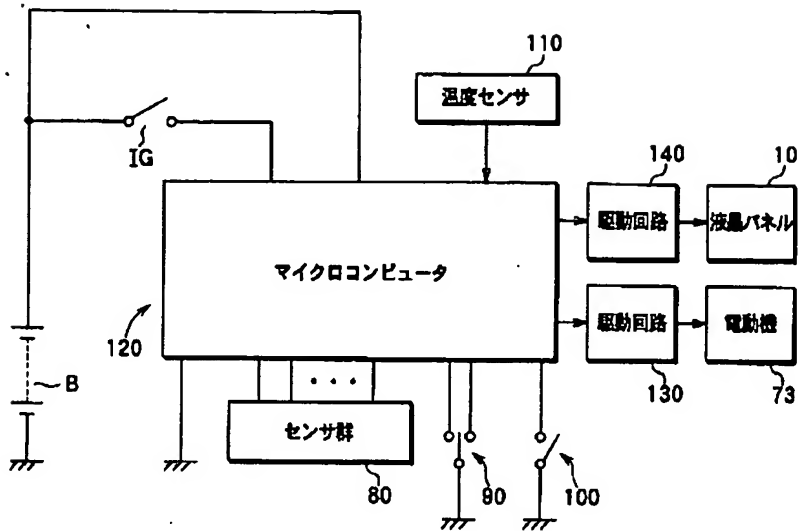
[Drawing 6]



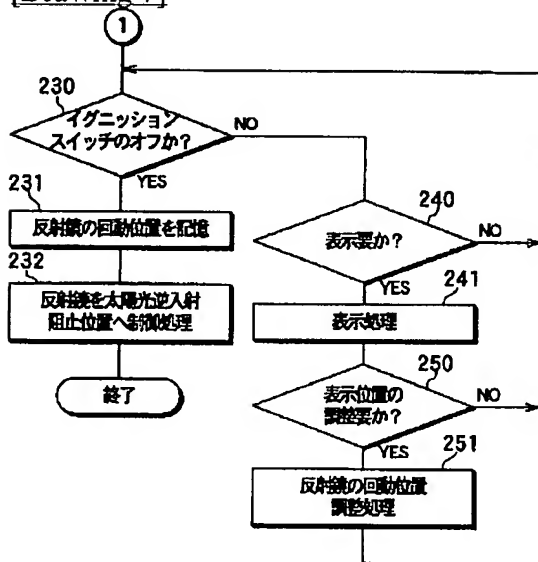
[Drawing 11]



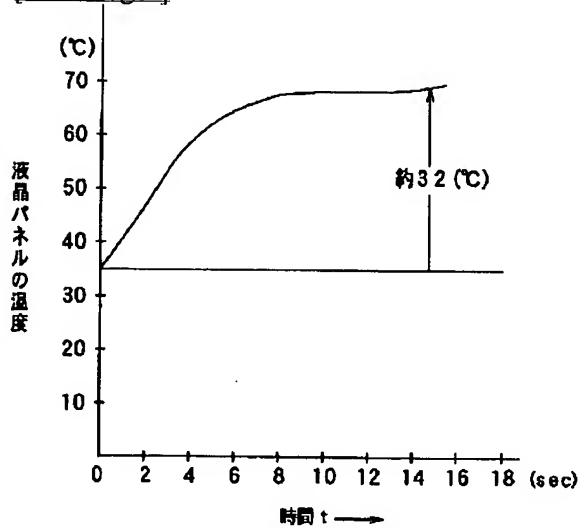
[Drawing 5]



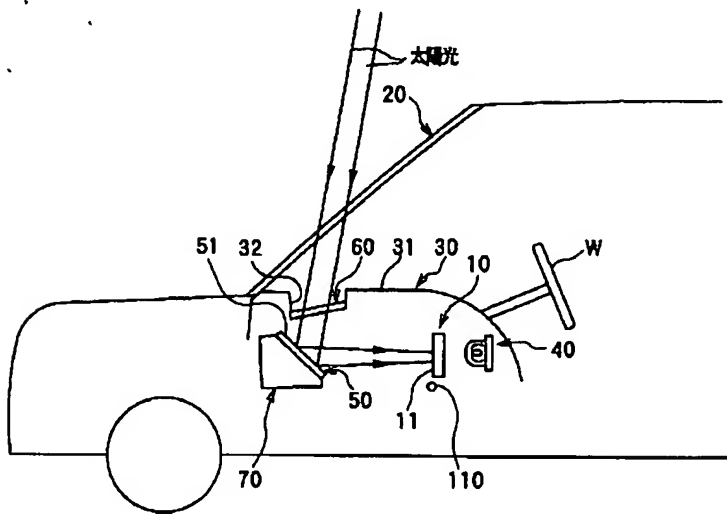
[Drawing 7]



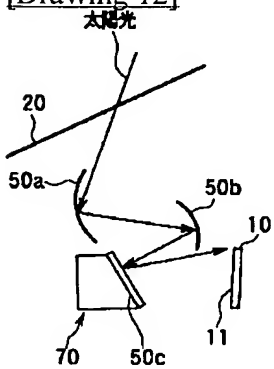
[Drawing 8]



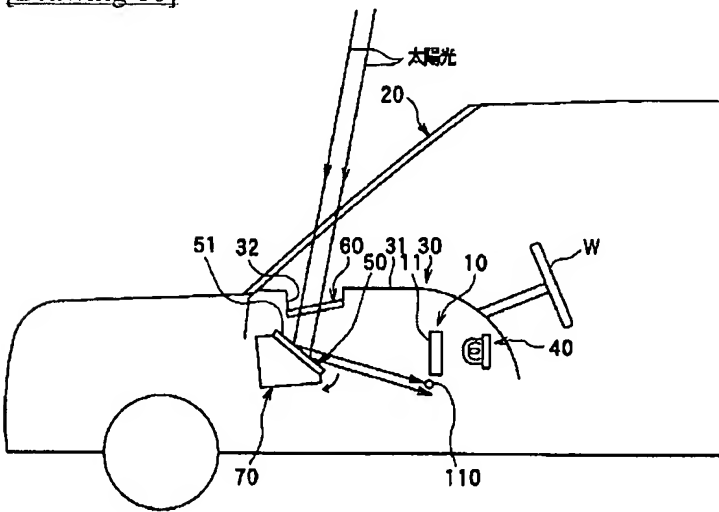
[Drawing 9]



[Drawing 12]



[Drawing 10]



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the HUD for cars.

[0002]

[Description of the Prior Art] Conventionally, as this kind of a HUD for cars, there are some which were indicated in JP,11-23997,A, for example.

[0003] A liquid crystal panel is arranged to the rear-face side of the instrument panel of the vehicle interior of a room, and when the light from the back light which penetrates this liquid crystal panel is turned to a front windshield with a reflecting mirror and it reflects, it is made to make an operator have checked by looking the virtual-image information on the liquid crystal panel ahead formed of this front windshield in this HUD.

[0004] A filter is infixed between a reflecting mirror and a liquid crystal panel, and while making a reflecting mirror turn and penetrate the light from a liquid crystal panel with this filter, it is made not to make the reflective heat ray by the reflecting mirror have penetrated to the liquid crystal panel with the above-mentioned HUD here, in order to protect a liquid crystal panel from the heat ray in the sunlight which carries out incidence through a front windshield.

[0005]

[Problem(s) to be Solved by the Invention] However, in the above-mentioned HUD, although a filter protects a liquid crystal panel from the heat ray of sunlight like to ****, since the expensive filter which intercepts the light of specific wavelength needs to be adopted as the filter concerned, there is fault of causing the cost quantity of a HUD. Moreover, when such a filter is adopted, for cutoff of the light of specific wavelength, the light from a liquid crystal panel will be intercepted partially, and the fault that the display brightness on the front windshield of the above-mentioned virtual-image information falls also has it.

[0006] Then, this invention aims at offering the HUD for cars which was not made to carry out reverse incidence of the sunlight from a front windshield to a drop, without the reflecting mirror which turns the light showing the display information on a drop to a front windshield, and is reflected being dependent on an excessive optical member, in order to cope with the above mentioned.

[0007]

[Means for Solving the Problem] The HUD for cars concerning invention according to claim 1 in solution of the above-mentioned technical problem A prime mover and the key switch for a starting halt of this prime mover (IG) The drop which carries out outgoing radiation of the display light which is arranged in the rear-face side of the instrument panel (30) located under the front windshield (20) in the vehicle interior of a room of the car which it has, and expresses display information according to actuation from the screen (11) (10 40), It has the reflecting mirror (50) which is arranged rotatable [in the vertical direction] ahead of the screen of a drop in the rear-face side of an instrument panel, and has the reflector (51) which can counter the above-mentioned screen, and a rotation justification means (70,200) to adjust the rotation location of a reflecting mirror.

[0008] And when incidence of the reflecting mirror is carried out in the display light from the screen of a drop in the basis of adjustment by the rotation justification means, and the above-mentioned reflector, according to the above-mentioned reflector, opening (32) of an instrument panel is turned to the internal surface of a through front windshield, this display light is reflected as an image formation light, and a front windshield reflects the above-mentioned image formation light in that internal surface, and displays display information as a virtual image.

[0009] In such a HUD for cars, a rotation justification means is characterized by adjusting the rotation location

of a reflecting mirror so that it may separate from the location where the reflector of a reflecting mirror counters the screen of a drop based on actuation of stopping the prime mover of a key switch.

[0010] Since the rotation location of a reflecting mirror is adjusted [after carrying out actuation of suspending the prime mover of a key switch, by this for example,] so that it may separate as mentioned above from the location where the reflector of a reflecting mirror counters the screen of a drop even if sunlight carries out reverse incidence to a reflecting mirror through a front windshield while long duration parking of the car is carried out, the reflective sunlight by the reflecting mirror does not carry out reverse incidence to a drop.

[0011] Therefore, in order to prevent the reverse incidence to the sunlight of a drop, it is not necessary to infix the filter which intercepts the light of specific wavelength between a drop and a reflecting mirror. Consequently, while an excessive large sum member called such an optical filter becomes unnecessary and leading to reduction of cost, reduction of the light of the drop at the time of using the filter concerned, as a result reduction of the display brightness in a front windshield can be prevented.

[0012] Moreover, the HUD for cars concerning invention according to claim 2 The basis of adjustment have the drop control means (100 240) which it has a drop, a reflecting mirror, and a rotation justification means like invention according to claim 1, and also controls a drop to an operating state or a non-operating state, and according [a reflecting mirror] to a rotation justification means, When incidence of the display light from the screen of a drop is carried out in the above-mentioned reflector, according to the above-mentioned reflector, turn opening (32) of an instrument panel to the internal surface of a through front windshield, and this display light is reflected as an image formation light. When a drop control means controls a drop to an operating state, a front windshield reflects the above-mentioned image formation light in the internal surface, and displays display information as a virtual image.

[0013] And in the HUD concerned, in connection with controlling so that a drop control means sets a drop to a non-operating state, a rotation justification means adjusts the rotation location of a reflecting mirror so that it may separate from the location where the reflector of a reflecting mirror counters the screen of a drop.

[0014] Thereby, when the drop has set to the non-operating state by the drop control means, even if sunlight carries out reverse incidence to a reflecting mirror through a front windshield after that, like invention according to claim 1, the reverse incidence to the drop of the reflective sunlight by the reflecting mirror is prevented, consequently the same operation effectiveness as invention according to claim 1 can be attained.

[0015] Moreover, the HUD for cars concerning invention according to claim 3 It has a drop, a reflecting mirror, and a rotation justification means like invention according to claim 1. A reflecting mirror When incidence of the display light from the screen of a drop is carried out in the basis of adjustment by the rotation justification means, and the above-mentioned reflector, according to the above-mentioned reflector, turn opening (32) of an instrument panel to the internal surface of a through front windshield, and this display light is reflected as an image formation light. A front windshield reflects the above-mentioned image formation light in the internal surface, and displays display information as a virtual image.

[0016] And a temperature detection means by which the HUD concerned detects the temperature of a drop (110), The rise inclination of the detection temperature of this temperature detection means equips the temperature rise inclination of the drop concerned by the reverse incidence to the drop through the front windshield of sunlight, and the reflector of a reflecting mirror with a temperature rise inclination judging means (210) to judge whether it is mostly in agreement. A rotation justification means The rotation location of a reflecting mirror is adjusted so that it may separate based on a judgment that it is mostly in agreement from the location by the temperature rise inclination judging means where the reflector of a reflecting mirror counters the screen of a drop.

[0017] Thus, since the rotation location of a reflecting mirror is adjusted so that it may separate based on a judgment that it is mostly in agreement from the location by the temperature rise inclination judging means where the reflector of a reflecting mirror counters the screen of a drop, even if sunlight carries out reverse incidence to a reflecting mirror through a front windshield, the reverse incidence to the drop of sunlight is prevented certainly. Consequently, the same operation effectiveness as invention according to claim 1 can be attained.

[0018] It has the drop control means (100 240) which controls a drop here to an operating state or a non-operating state in claim 1 or the HUD for cars given in 3 according to invention according to claim 4, and in connection with controlling so that this drop control means sets a drop to a non-operating state, a rotation justification means adjusts the rotation location of a reflecting mirror so that it may separate from the location

where the reflector of a reflecting mirror counters the screen of a drop.

[0019] Thereby, also when a drop sets to a non-operating state, the operation effectiveness of invention according to claim 1 or 3 and the same operation effectiveness may be attained.

[0020] Moreover, according to invention according to claim 5, it sets to the HUD for cars according to claim 1. The rise inclination of the detection temperature of a temperature detection means (110) to detect the temperature of a drop, and this temperature detection means The temperature rise inclination of the drop concerned by the reverse incidence to the drop through the front windshield of sunlight and the reflector of a reflecting mirror is equipped with a temperature rise inclination judging means (210) to judge whether it is mostly in agreement. A rotation justification means adjusts the rotation location of a reflecting mirror so that it may separate based on a judgment that it is mostly in agreement from the location by the temperature rise inclination judging means where the reflector of a reflecting mirror counters the screen of a drop.

[0021] Also when the rise inclination of the detection temperature of a temperature detection means is mostly in agreement with the temperature rise inclination of the drop concerned by the reverse incidence to the drop through the front windshield of sunlight, and the reflector of a reflecting mirror by this, the same operation effectiveness as invention according to claim 1 can be attained.

[0022] Moreover, according to invention according to claim 6, it sets to claim 1 or the HUD for cars given in 3. The drop control means which controls a drop to an operating state or a non-operating state (100 240), It has the modification actuation means (90) operated when changing a reflecting mirror into a desired rotation location. A rotation justification means It follows on controlling so that a drop control means sets a drop to an operating state. The basis of actuation of a modification actuation means, The rotation location of a reflecting mirror is adjusted so that it may separate from the location where the reflector of a reflecting mirror counters the screen of a drop in connection with controlling so that a reflecting mirror is adjusted to a desired rotation location and a drop control means sets a drop to a non-operating state.

[0023] Also when a drop sets the basis of actuation of a modification actuation means, and a reflecting mirror to a non-operating state by the drop control means in the condition of having adjusted to the desired rotation location, by this, claim 1 or the same operation effectiveness as invention given in 3 can be attained.

[0024] The HUD for cars concerning invention according to claim 7 Have a drop, a reflecting mirror, a rotation justification means, and a drop control means like invention according to claim 2, and also It has the modification actuation means (90) operated when changing a reflecting mirror into a desired rotation location, and follows on controlling so that a drop control means sets a drop to an operating state. A rotation justification means The basis of actuation of a modification actuation means and a reflecting mirror are adjusted to a desired rotation location. A reflecting mirror When incidence of the display light from the screen of a drop is carried out in the basis of adjustment by the rotation justification means, and the above-mentioned reflector, according to the above-mentioned reflector, turn opening (32) of an instrument panel to the internal surface of a through front windshield, and this display light is reflected as an image formation light. When a drop control means controls a drop to an operating state, a front windshield reflects the above-mentioned image formation light in the internal surface, and displays display information as a virtual image.

[0025] And in the HUD concerned, in connection with controlling so that a drop control means sets a drop to a non-operating state, a rotation justification means adjusts the rotation location of a reflecting mirror so that it may separate from the location where the reflector of a reflecting mirror counters the screen of a drop.

[0026] Thereby, also when a drop sets to a non-operating state by the drop control means, the same operation effectiveness as invention according to claim 2 can be attained.

[0027] According to invention according to claim 8, it sets to claim 1 or the HUD for cars given in 5 here. A rotation justification means When it is operated so that a key switch may put a prime mover into operation after adjusting the rotation location of a reflecting mirror so that it may separate from the location where the reflector of a reflecting mirror counters the screen of a drop based on actuation of stopping the prime mover of a key switch, A rotation justification means adjusts the rotation location of a reflecting mirror so that the reflector of a reflecting mirror may counter the screen of a drop.

[0028] Thereby, the normal usable condition as a HUD is securable by returning the rotation location of a reflecting mirror to the original location, after the condition of the reverse incidence to the reflecting mirror of sunlight is lost not to mention the ability to attain claim 1 or the operation effectiveness of invention given in 5.

[0029] Moreover, according to invention according to claim 9, it sets to claim 2 or the HUD for cars given in 7. When a drop sets to an operating state after adjusting the rotation location of a reflecting mirror so that it may

separate from the location where the reflector whose rotation justification means is a reflecting mirror counters the screen of a drop in connection with controlling so that a drop control means sets a drop to a non-operating state, A rotation justification means adjusts the rotation location of a reflecting mirror so that the reflector of a reflecting mirror may counter the screen of a drop.

[0030] Thereby, the normal usable condition as a HUD is securable by returning the rotation location of a reflecting mirror to the original location, when a drop sets to an operating state not to mention the ability to attain claim 2 or the operation effectiveness of invention given in 7.

[0031] Moreover, according to invention according to claim 10, it sets to claim 3 or the HUD for cars given in 5. When predetermined time progress is carried out after the rotation justification means adjusted the rotation location of a reflecting mirror so that a drop control means might separate from the location by the temperature rise inclination judging means where the reflector of a reflecting mirror counters the screen of a drop based on a judgment that it is mostly in agreement, a rotation justification means The rotation location of a reflecting mirror is adjusted so that the reflector of a reflecting mirror may counter the screen of a drop.

[0032] Thereby, the normal usable condition as a HUD is securable by returning the rotation location of a reflecting mirror to the original location, when [at which it is based on a temperature rise inclination judging means] if mostly in agreement carries out after [a judgment] predetermined time progress not to mention the ability to attain claim 3 or the operation effectiveness of invention given in 5.

[0033] Moreover, according to invention according to claim 11, it sets to claim 1 thru/or the HUD for cars of any one publication of ten. A reflecting mirror is a concave mirror and a key switch is an ignition switch. A drop Adjustment of the rotation location of the concave mirror which consists of the light source which are a transparency mold liquid crystal panel and its back light, and is made by the rotation justification means so that it may separate from the location where the reflector of a concave mirror counters the screen of said liquid crystal panel It is adjustment of the rotation location of the concave mirror made by the rotation justification means so that the reflector of a concave mirror may face the upper part of the screen of a liquid crystal panel, or a lower part.

[0034] This can also attain claim 1 thru/or the operation effectiveness as invention of a publication that even either of 10 is the same.

[0035] In addition, the sign in the parenthesis of each above-mentioned means shows correspondence relation with the concrete means of a publication to the operation gestalt mentioned later.

[0036]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained based on drawing 1 thru/or drawing 10 . Drawing 1 shows the example by which the HUD concerning this invention was applied to the automobile.

[0037] This HUD is equipped with the transparency mold liquid crystal panel 10, and this liquid crystal panel 10 is arranged in the shape of a vertical by the member proper at that rear-face side by the instrument panel 30 which extends to the margo-inferior section empty vehicle indoor lower part of the front windshield 20 of the automobile concerned.

[0038] Moreover, the HUD concerned is equipped with the light source 40, and this light source 40 functions as a back light of a liquid crystal panel 10, and carries out outgoing radiation of the light towards this liquid crystal panel 10.

[0039] Moreover, the reflecting mirror 50 is arranged in the screen 11 side of a liquid crystal panel 10, and this reflecting mirror 50 has the common optical axis P with a liquid crystal panel 10 and the light source 40. The reflecting mirror 50 concerned consists of a concave mirror, and this reflecting mirror 50 is supported by the rotation adjusting device 70 rotatable ahead [of the liquid crystal panel / directly under / 10 of the protection-against-dust covering 60]. In addition, the protection-against-dust covering 60 consists of resin and glass of transparence, and this protection-against-dust covering 60 is attached in the opening 32 of the upper wall 31 of an instrument panel 30.

[0040] When a deer is carried out and this reflecting mirror 50 is in the rotation location (rotation location which counters the both sides of the screen 11 of the protection-against-dust covering 60 and a liquid crystal panel 10) which overlooks the both sides of the screen 11 of the protection-against-dust covering 60 and a liquid crystal panel 10 in that reflector 51, From the screen 11 of a liquid crystal panel 10, in accordance with an optical axis P, incidence of the reflecting mirror 50 concerned is carried out, it reflects the light showing display information, and carries out incidence of the protection-against-dust covering 60 to the through front windshield

20 as an image formation light. If it puts in another way, as drawing 1 shows the display information on a liquid crystal panel 10, a reflecting mirror 50 will be formed as a virtual image 52, and will carry out image formation of this virtual image 52 a core [point 20a] on the internal surface of the front windshield 20.

[0041] Thereby, the front windshield 20 carries out incidence of the incident light from a reflecting mirror 50 to Operator's M eye through right above [of the steering wheel W of the automobile concerned]. This means that Operator M checks the above-mentioned display information by looking as a virtual image 21 ahead [of the front windshield 20].

[0042] As drawing 2 shows the rotation adjusting device 70, it has the body 71 of equipment and this body 71 of equipment is supporting the reflecting mirror 50 rotatable to the illustration clockwise rotation or the counterclockwise rotation in drawing 2 with the rotation shaft 72 supported rotatable with that both-arms-like supporter (not shown). In addition, the rotation shaft 72 is located in the center of the vertical direction of a reflecting mirror 50.

[0043] Moreover, the rotation adjusting device 70 is equipped with the motor 73, and this motor 73 is formed in one side attachment wall of the body 71 of equipment at that pars basilaris ossis occipitalis. The output-shaft 73a is turned to the method of outside from the body 71 top Norikazu side attachment wall of equipment, and the motor 73 is making it extend at a right angle here. The pinion gear 74 is supported by output-shaft 73a of a motor 73 in same axle, and this pinion gear 74 is rotatable in a field parallel to the body 71 top Norikazu side attachment wall of equipment.

[0044] Sector gear 75 are supported in same axle from the body 71 top Norikazu side attachment wall of equipment by rotation shaft 75a which extends rotatable at a right angle to this focusing on that rotation, and these sector gear 75 have geared to the pinion gear 74 in circular engagement section 75b formed in that circular periphery section. This rotates sector gear 75 to hard flow according to rotation of a pinion gear 74 focusing on rotation shaft 75a.

[0045] These sector gear 75 are equipped with lock section 75c and 75d of toothless sections. As drawing 2 and drawing 3 show lock section 75c, it is formed in the end side of the circular periphery section of sector gear 75, and this lock section 75c locks rotation of a pinion gear 74 and sector gear 75, when it rotates clockwise to the location which sector gear 75 show by drawing 2 . Moreover, as drawing 2 and drawing 3 show 75d of toothless sections, it is formed in the other end side of the circular periphery section of sector gear 75, and after 75d of this toothless section rotates counterclockwise to the location which sector gear 75 show by drawing 3 , it cancels engagement with the pinion gear 73 of sector gear 75.

[0046] It is supported by rotation shaft 75a in same axle, and sector gear 77 have geared in that circular engagement section 77a on this middle gear 76 so that the middle gear 76 of a minor diameter may be rotated in one with sector gear 75. These sector gear 77 are supported by the rotation shaft 72 fixed with the center of the vertical direction of a reflecting mirror 50 focusing on that rotation. This really rotates sector gear 77 according to rotation of the rotation shaft 72 with a reflecting mirror 50.

[0047] The coil spring 78 is attached between some bodies 71 of equipment, and the upper limit section of a reflecting mirror 50, and this coil spring 78 always energizes a reflecting mirror 50 counterclockwise.

[0048] Next, the control circuit for a liquid crystal panel 10 and a motor 73 is explained with reference to drawing 5 . This control circuit is equipped with the sensor groups 80, such as a speed sensor and a rotation sensor, and this sensor group 80 detects automobile information, such as the vehicle speed of the automobile concerned, and an engine rotational frequency. When adjusting the rotation location of a reflecting mirror 50, it changes the switch actuation of the switch actuation switch 90 into the 1st or 2nd switch condition. In addition, the actuation to the 1st switch condition of the switch actuation switch 90 corresponds to the rotation to the clockwise rotation of a reflecting mirror 50, and the actuation to the 2nd switch condition of the switch actuation switch 90 corresponds to the rotation to the counterclockwise rotation of a reflecting mirror 50.

[0049] Moreover, when displaying the actuation switch 100 on a liquid crystal panel 10, it is closed, and when suspending the display of a liquid crystal panel 10, Kaisei of it is carried out. The temperature sensor 110 is arranged near the liquid crystal panel 10, and this temperature sensor 110 detects the ambient temperature of a liquid crystal panel 10 as temperature of the liquid crystal panel concerned.

[0050] A microcomputer 120 performs a computer program according to the flow chart of drawing 6 and drawing 7 , and carries out rotation control processing of a motor 73 through the drive circuit 130 according to switch actuation of the switch actuation switch 90 or the output of a temperature sensor 110 during this activation, and presenting of the automobile information by the liquid crystal panel 10 and processing of that

halt carry out through the drive circuit 140 according to the output of the sensor group 80, or actuation of the actuation switch 100. In addition, electric power is always supplied to a microcomputer 120 from the dc-battery B of loading in the automobile concerned, it is in an operating state, and starts activation of a computer program with ON of the ignition switch IG of the automobile concerned. Moreover, the above-mentioned computer program is beforehand memorized by ROM of a microcomputer 120.

[0051] the basis of control according [the drive circuit 130] to a microcomputer 120, and a reflecting mirror 50 -- a clockwise rotation -- or a motor 73 is driven so that it may be made to rotate counterclockwise. The drive circuit 140 carries out the display drive of the basis of control by the microcomputer 120, and the liquid crystal panel 10.

[0052] Thus, in this constituted operation gestalt, the automobile concerned should set to the run state also as that of ON of an ignition switch IG. Moreover, a microcomputer 120 starts activation of a computer program according to the flow chart of drawing 6 and drawing 7 with ON of an ignition switch IG.

[0053] In connection with this, the rotation location of a reflecting mirror 50 is set as an initial valve position in step 200. The processing which specifically doubles the rotation location of the reflecting mirror 50 concerned with the rotation location of the reflecting mirror 50 memorized before the above-mentioned ON of an ignition switch IG in step 231 is made. With this processing, the drive circuit 130 drives a motor 73 so that a reflecting mirror 50 may be rotated to the above-mentioned initial valve position.

[0054] In step 201, the detection temperature (henceforth the detection temperature T) of a temperature sensor 110 is inputted into a microcomputer 120 the appropriate back. Then, the actual temperature gradient ($\Delta T / \Delta t$) of the detection temperature T is computed at step 202. Subsequently, in step 210, it is judged whether the above-mentioned temperature gradient ($\Delta T / \Delta t$) is predetermined temperature rise inclination ($\Delta T_0 / \Delta t$).

[0055] With this operation gestalt, the predetermined temperature rise inclination ($\Delta T_0 / \Delta t$) concerned is introduced into the basis of the following bases. As sunlight showed by drawing 9, when reverse incidence was carried out to a liquid crystal panel 10 through the front windshield 20 and a reflecting mirror 50 and it investigated about what kind of change the heat ray of sunlight gives to the temperature of a liquid crystal panel 10, data as shown by drawing 8 were obtained.

[0056] When sunlight began to have carried out reverse incidence as mentioned above through the front windshield 20 to the liquid crystal panel 10 currently maintained by 35 (degree C) by time amount $t = 0$ (sec) according to this, and about 15 (sec) **** was taken, about 32 (degree C) rise of the temperature of a liquid crystal panel 10 was carried out. The temperature rise inclination of the liquid crystal panel in the above $t = 0$ by the thing reason and drawing 8 from which this temperature rise becomes the cause of doing damage by heat to a liquid crystal panel 10 was introduced as the above-mentioned predetermined temperature rise inclination ($\Delta T_0 / \Delta t$). Moreover, it is the time amount in which sunlight carries out incidence to the inside of a day continuously through the front windshield 20 between [about 15 (sec)] the above.

[0057] Here, if the temperature gradient ($\Delta T / \Delta t$) is in agreement with predetermined temperature rise inclination ($\Delta T_0 / \Delta t$), this will be produced because sunlight carries out reverse incidence to a liquid crystal panel 10 through a reflecting mirror 50 through the front windshield 20. For this reason, the judgment in step 210 serves as YES, and control processing of the rotation location of a reflecting mirror 50 is made so that the incidence of the reflective sunlight of a reflecting mirror 50 to a liquid crystal panel 10 may be prevented at step 211.

[0058] Control processing to which the rotation location of a reflecting mirror 50 specifically turns into a location (henceforth a sunlight reverse incidence inhibition location) shown by drawing 4 is made. However, as the sunlight which carried out incidence to the reflector 51 of a reflecting mirror 50 through the front windshield 20 shows the rotation location of the reflecting mirror 50 in drawing 4 in drawing 10 according to a reflector 51, it is the location reflected towards the lower part of a liquid crystal panel 10.

[0059] In connection with this, a motor 73 drives by the drive circuit 130 so that the rotation location of a reflecting mirror 50 may be made into the above-mentioned sunlight reverse incidence inhibition location. That is, a pinion gear 74 rotates counterclockwise with a motor 73, sector gear 75 rotate clockwise with the middle gear 76 by the pinion gear 74, and sector gear 77 rotate counterclockwise with a reflecting mirror 50 by the middle gear 76, and make the rotation location of the reflecting mirror 50 concerned the above-mentioned sunlight reverse incidence inhibition location.

[0060] Thereby, even if sunlight carries out incidence to the reflector 51 of a reflecting mirror 50 through the

front windshield 20, the sunlight which carried out incidence in this way is reflected by the reflector 51 of a reflecting mirror 50 towards the lower part of a liquid crystal panel 10 (R> drawing 10 0 reference). Therefore, since the reverse incidence to the liquid crystal panel 10 of sunlight is certainly prevented with sufficient timing, damage on the liquid crystal panel 10 by the heat ray of sunlight may be prevented certainly.

[0061] In step 220, it is judged the appropriate back whether about 15 minutes passed after the judgment with YES in step 210. Since the reverse incidence of sunlight mentioned above is lost about 15 minutes after, the judgment in step 220 serves as YES. In connection with this, the processing which returns the rotation location of a reflecting mirror 50 to the rotation location in step 200 is made in the following step 221. By this, rotation justification equipment 70 drives by the drive circuit 130 with a motor 73, and rotates a reflecting mirror 50, and it returns to the rotation location in step 200.

[0062] Thus, the normal usable condition as a HUD is securable by returning the rotation location of a reflecting mirror 50 to the original location, after the condition of the reverse incidence to the reflecting mirror 50 of sunlight is lost.

[0063] When it is judged with NO in step 210 after carrying out processing at step 221 as mentioned above or, it is judged in step 230 whether an ignition switch IG is off. At a present stage, since the ignition switch IG is turned on, the judgment with NO is carried out in step 230, and it is judged for the display by the liquid crystal panel 10 in step 240 whether it is the need.

[0064] Here, if the actuation switch 100 is closed in order to make it display on a liquid crystal panel 10, the judgment in step 240 will serve as YES. In connection with this, display processing of the liquid crystal panel 10 about automobile information is made in step 241. For this reason, a display drive is carried out by the basis of the light from the light source 40, and the drive circuit 140, and a liquid crystal panel 10 carries out incidence of the display information to the reflector of a reflecting mirror 50 through light. Then, it is reflected by the reflector 51 and incidence of the light showing the display information which carried out incidence in this way is carried out to the internal surface of the front windshield 20 through the protection-against-dust covering 60. In connection with this, as a thing showing display information, it is reflected by the front windshield 20 and incidence of this incident light is carried out to Operator's M eye. For this reason, this operator M checks display information by looking as a virtual image 21.

[0065] In this case, since a reflecting mirror 50 is a concave mirror, image formation of the virtual image 52 formed with this reflecting mirror 50 is expanded and carried out more far away. Therefore, image formation also of the virtual image 21 by the front windshield 20 is expanded and carried out more ahead. Consequently, a virtual image 21 turns into an image which is easy to check by looking for Operator M.

[0066] Moreover, since the reverse incidence of the sunlight to a liquid crystal panel 10 is prevented by control of the rotation location of a reflecting mirror 50 like ****, it is not necessary to infix the filter which intercepts the light of specific wavelength between a liquid crystal panel 10 and a reflecting mirror 50. Therefore, while an excessive large sum member called such an optical filter becomes unnecessary and leading to reduction of cost, reduction of the light of the liquid crystal panel 10 at the time of using the filter concerned, i.e., reduction of the display brightness in the front windshield 20, can be prevented.

[0067] After processing at step 241, in step 150, the necessity of the adjustment about the display position of the display information on the front windshield 20 is judged. Here, if it changes the switch actuation of the switch actuation switch 90 into the 1st or 2nd switch condition, the judgment in step 250 will serve as YES.

[0068] The processing to which only a predetermined include angle rotates a reflecting mirror 50 to a clockwise rotation when the switch actuation switch 90 is in the 1st switch condition in step 251 in connection with this is made, and on the other hand, when the switch actuation switch 90 is in the 2nd switch condition, the processing to which only a predetermined include angle rotates a reflecting mirror 50 to a counterclockwise rotation is made. For this reason, a reflecting mirror 50 rotates only a predetermined include angle to a clockwise rotation or a counterclockwise rotation with rotation justification equipment 70. Thereby, according to the physique of the crew who sat down in automobilism seat concerned, or the location of a driver's seat, the display position of the virtual image on the front windshield 20 can be adjusted proper.

[0069] Then, if the automobile concerned is stopped and an ignition switch IG is turned off, the judgment in step 230 will be set to YES. Then, a microcomputer 120 carries out renewal of storage of the newest rotation location of a reflecting mirror 50 at step 231 in a basis with an off ignition switch IG, and the operating state to which electric power was directly supplied from Dc-battery B. Subsequently, in step 232, the processing which makes the rotation location of a reflecting mirror 50 the above-mentioned sunlight reverse incidence inhibition

location is made. With this processing, a reflecting mirror 50 drives with rotation justification equipment 70 like ****, and is adjusted to a sunlight reverse incidence inhibition location.

[0070] Therefore, even if the condition that sunlight carries out [the automobile concerned] reverse incidence like **** through the front windshield 20 after the halt while [long] time amount parking is carried out occurs, since a liquid crystal panel 10 turns sunlight caudad like **** and a reflecting mirror 50 reflects according to the reflector 51, sunlight does not carry out incidence to a liquid crystal panel 10. Consequently, the operation effectiveness accompanying processing at the above-mentioned step 211 and the same operation effectiveness are securable.

[0071] In addition, although the above-mentioned operation gestalt explained the example which is made to rotate a reflecting mirror 50 counterclockwise and is made into a sunlight reverse incidence inhibition location, it is good also considering the location which replaces with this and is shown by drawing 3 of a reflecting mirror 50 as the above-mentioned sunlight reverse incidence inhibition location. Also in this case, since the sunlight which carries out incidence through the front windshield 20 does not carry out incidence to the reflector 51 of a reflecting mirror 50, the reverse incidence of the sunlight to a liquid crystal panel 10 is prevented, and the same operation effectiveness as the above-mentioned operation gestalt can be attained.

[0072] Drawing 11 shows the modification of the above-mentioned operation gestalt. In this modification, in the above-mentioned operation gestalt, it replaces with a reflecting mirror 50 and has composition which adopted both the concave mirrors 50a and 50b and plane mirror 50c. Here, as drawing 11 shows, both the concave mirrors 50a and 50b are arranged directly under the protection-against-dust covering 60 stated with the above-mentioned operation gestalt so that it may face mutually in each of that reflector. Moreover, in the rotation justification equipment 70 stated with the above-mentioned operation gestalt, plane mirror 50c is replaced with a reflecting mirror 50, and is really supported by the rotation shaft 72 of the body 71 of equipment rotatable like this reflecting mirror 50.

[0073] And when plane mirror 50c is adjusted in the location which overlooks the both sides of the reflector of concave mirror 50b, and the screen 11 of a liquid crystal panel 10 in the reflector by rotation justification equipment 70, sequential reflection is carried out by each reflector of plane mirror 50c, concave mirror 50b, and concave mirror 50a, and the light showing the automobile information on a liquid crystal panel 10 carries out incidence to the internal surface of the front windshield 20 through the protection-against-dust covering 60. Thereby, the display as a virtual image of display information is made like the above-mentioned operation gestalt. Other configurations are the same as that of the above-mentioned operation gestalt.

[0074] The sunlight which carries out incidence through the front windshield 20 in this constituted modification as shown in drawing 1111. Thus, both concave mirror 50a, Even if the situation which sequential reflection is carried out by 50b and plane mirror 50c, and carries out incidence to a liquid crystal panel 10 occurs. The basis of the judgment with YES in step 210 or step 230 and the rotation location of plane mirror 50c are adjusted in the sunlight reverse incidence inhibition location shown by drawing 12 by rotation justification equipment 70 like the above-mentioned operation gestalt. Thereby, the operation effectiveness accompanying processing at step 211 or step 232 stated with the above-mentioned operation gestalt and the same operation effectiveness may be attained also in this modification.

[0075] In addition, although the above-mentioned operation gestalt and the modification explained the example by which this invention was applied to the HUD for automobiles, generally you may carry out with the application of this invention to the various HUDs for cars, without restricting to this.

[0076] Moreover, in operation of this invention, an automobile may be an electric vehicle, and as it judges step 230 as actuation of a key switch (it corresponding to an ignition switch IG) of performing start actuation of an electric vehicle being in this case, it processes after step 231.

[0077] Moreover, in operation of this invention, it may replace with a liquid crystal panel 10 and the light source 40, and spontaneous light type an EL panel (luminescent cell), light emitting diode, a cold cathode discharge tube, etc. may be adopted.

[0078] Moreover, you may make it apply this invention to the HUD which was made to perform in the liquid crystal panel 10 in operation of this invention with the photosensor used in order to modulate the light of modulated light of the image displayed on the front windshield 20 according to surrounding brightness, or a modulated light switch.

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CLAIMS

[Claim(s)]

[Claim 1] A prime mover and the key switch for a starting halt of this prime mover (IG) The drop which carries out outgoing radiation of the display light which is arranged in the rear-face side of the instrument panel (30) located under the front windshield (20) in the vehicle interior of a room of the car which it has, and expresses display information according to actuation from the screen (11) (10 40), The reflecting mirror which is arranged rotatable [in the vertical direction] ahead of the screen of said drop in the rear-face side of said instrument panel, and has the reflector (51) which can counter said screen (50), It has a rotation justification means (70,200) to adjust the rotation location of said reflecting mirror. Said reflecting mirror When incidence of the display light from the screen of said drop is carried out in the basis of adjustment by said rotation justification means, and said reflector, according to said reflector, turn opening (32) of said instrument panel to the internal surface of the through aforementioned front windshield, and this display light is reflected as an image formation light. In the HUD for cars which said front windshield reflects said image formation light in the internal surface, and displayed said display information as a virtual image Said rotation justification means is a HUD for cars characterized by adjusting the rotation location of said reflecting mirror so that it may separate based on actuation of stopping said prime mover of said key switch, from the location where the reflector of said reflecting mirror counters the screen of said drop.

[Claim 2] A prime mover and the key switch for a starting halt of this prime mover (IG) The drop which carries out outgoing radiation of the display light which is arranged in the rear-face side of the instrument panel (30) located under the front windshield (20) in the vehicle interior of a room of the car which it has, and expresses display information according to actuation from the screen (10 40), The reflecting mirror which is arranged rotatable [in the vertical direction] ahead of the screen of said drop in the rear-face side of said instrument panel, and has the reflector (51) which can counter said screen (50), A rotation justification means to adjust the rotation location of said reflecting mirror (70,200), It has the drop control means (100 240) which controls said drop to an operating state or a non-operating state. Said reflecting mirror When incidence of the display light from the screen of said drop is carried out in the basis of adjustment by said rotation justification means, and said reflector, according to said reflector, turn opening (32) of said instrument panel to the internal surface of the through aforementioned front windshield, and this display light is reflected as an image formation light. In the HUD for cars which said front windshield reflects said image formation light in the internal surface, and displayed said display information as a virtual image when said drop control means controlled said drop to an operating state It follows on controlling so that said drop control means sets said drop to a non-operating state. Said rotation justification means The HUD for cars characterized by adjusting the rotation location of said reflecting mirror so that it may separate from the location where the reflector of said reflecting mirror counters the screen of said drop.

[Claim 3] A prime mover and the key switch for a starting halt of this prime mover (IG) The drop which carries out outgoing radiation of the display light which is arranged in the rear-face side of the instrument panel (30) located under the front windshield (20) in the vehicle interior of a room of the car which it has, and expresses display information according to actuation from the screen (10 40), The reflecting mirror which is arranged rotatable [in the vertical direction] ahead of the screen of said drop in the rear-face side of said instrument panel, and has the reflector (51) which can counter said screen (50), It has a rotation justification means (70,200) to adjust the rotation location of said reflecting mirror. Said reflecting mirror When incidence of the display light from the screen of said drop is carried out in the basis of adjustment by said rotation justification means, and said reflector, according to said reflector, turn opening (32) of said instrument panel to the internal

surface of the through aforementioned front windshield, and this display light is reflected as an image formation light. In the HUD for cars which said front windshield reflects said image formation light in the internal surface, and displayed said display information as a virtual image The rise inclination of the detection temperature of a temperature detection means (110) to detect the temperature of said drop, and this temperature detection means The temperature rise inclination of the drop concerned by the reverse incidence to said drop through said front windshield of sunlight and the reflector of said reflecting mirror is equipped with a temperature rise inclination judging means (210) to judge whether it is mostly in agreement. Said rotation justification means is a HUD for cars characterized by adjusting the rotation location of said reflecting mirror so that it may separate based on a judgment that it is mostly in agreement from the location by said temperature rise inclination judging means where the reflector of said reflecting mirror counters the screen of said drop.

[Claim 4] In connection with having the drop control means (100 240) which controls said drop to an operating state or a non-operating state, and controlling so that this drop control means sets said drop to a non-operating state, said rotation justification means is claim 1 characterized by adjusting the rotation location of said reflecting mirror so that it may separate from the location where the reflector of said reflecting mirror counters the screen of said drop, or a HUD for cars given in 3.

[Claim 5] The rise inclination of the detection temperature of a temperature detection means (110) to detect the temperature of said drop, and this temperature detection means The temperature rise inclination of the drop concerned by the reverse incidence to said drop through said front windshield of sunlight and the reflector of said reflecting mirror is equipped with a temperature rise inclination judging means (210) to judge whether it is mostly in agreement. Said rotation justification means so that it may separate based on a judgment that it is mostly in agreement from the location by said temperature rise inclination judging means where the reflector of said reflecting mirror counters the screen of said drop The HUD for cars according to claim 1 characterized by adjusting the rotation location of said reflecting mirror.

[Claim 6] The drop control means which controls said drop to an operating state or a non-operating state (100 240), It has the modification actuation means (90) operated when changing said reflecting mirror into a desired rotation location. Said rotation justification means It follows on controlling so that said drop control means sets said drop to an operating state. The basis of actuation of said modification actuation means, So that it may separate in connection with controlling so that said reflecting mirror is adjusted to a desired rotation location and said drop control means sets said drop to a non-operating state from the location where the reflector of said reflecting mirror counters the screen of said drop Claim 1 characterized by adjusting the rotation location of said reflecting mirror, or the HUD for cars given in 3.

[Claim 7] A prime mover and the key switch for a starting halt of this prime mover (1G) The drop which carries out outgoing radiation of the display light which is arranged in the rear-face side of the instrument panel (30) located under the front windshield (20) in the vehicle interior of a room of the car which it has, and expresses display information according to actuation from the screen (10 40), The reflecting mirror which is arranged rotatable [in the vertical direction] ahead of the screen of said drop in the rear-face side of said instrument panel, and has the reflector (51) which can counter said screen (50), A rotation justification means to adjust the rotation location of said reflecting mirror (70,200), The drop control means which controls said drop to an operating state or a non-operating state (100 240), It has the modification actuation means (90) operated when changing said reflecting mirror into a desired rotation location. It follows on controlling so that said drop control means sets said drop to an operating state. Said rotation justification means The basis of actuation of said modification actuation means and said reflecting mirror are adjusted to a desired rotation location. Said reflecting mirror When incidence of the display light from the screen of said drop is carried out in the basis of adjustment by said rotation justification means, and said reflector, according to said reflector, turn opening (32) of said instrument panel to the internal surface of the through aforementioned front windshield, and this display light is reflected as an image formation light. In the HUD for cars with which said front windshield reflects said image formation light in the internal surface, and displayed said display information as a virtual image when said drop control means controlled said drop to an operating state It follows on controlling so that said drop control means sets said drop to a non-operating state. Said rotation justification means The HUD for cars characterized by adjusting the rotation location of said reflecting mirror so that it may separate from the location where the reflector of said reflecting mirror counters the screen of said drop.

[Claim 8] Said rotation justification means is based on actuation of stopping said prime mover of said key switch. When it is operated so that said key switch may put said prime mover into operation after adjusting the rotation location of said reflecting mirror so that it may separate from the location where the reflector of said

reflecting mirror counters the screen of said drop, Said rotation justification means is claim 1 characterized by adjusting the rotation location of said reflecting mirror so that the reflector of said reflecting mirror may counter the screen of said drop, or a HUD for cars given in 5.

[Claim 9] When said drop sets to an operating state after adjusting the rotation location of said reflecting mirror so that said rotation justification means may separate in connection with controlling so that said drop control means sets said drop to a non-operating state from the location where the reflector of said reflecting mirror counters the screen of said drop, Said rotation justification means is claim 2 characterized by adjusting the rotation location of said reflecting mirror so that the reflector of said reflecting mirror may counter the screen of said drop, or a HUD for cars given in 7.

[Claim 10] When predetermined time progress is carried out after said rotation justification means adjusted the rotation location of said reflecting mirror so that said drop control means might separate from the location by said temperature rise inclination judging means where the reflector of said reflecting mirror counters the screen of said drop based on a judgment that it is mostly in agreement, Said rotation justification means is claim 3 characterized by adjusting the rotation location of said reflecting mirror so that the reflector of said reflecting mirror may counter the screen of said drop, or a HUD for cars given in 5.

[Claim 11] Said reflecting mirror is a concave mirror and said key switch is an ignition switch. Said drop Adjustment of the rotation location of said concave mirror which consists of the light source which are a transparency mold liquid crystal panel and its back light, and is made by said rotation justification means so that it may separate from the location where the reflector of said concave mirror counters the screen of said liquid crystal panel Claim 1 characterized by being adjustment of the rotation location of said concave mirror made by said rotation justification means so that the reflector of said concave mirror may face the upper part of the screen of said liquid crystal panel, or a lower part thru/or the HUD for cars of any one publication of ten.

[Translation done.]

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